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Daniel A. Lerner

University of Colorado, daniel.lerner@colorado.edu

G. Crawford

Ohio University

James Bort

Syracuse University

Johan Wiklund

Syracuse University

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SPEED VERSUS ACCURACY: EXPERIMENTALLY MODELING THE STRATEGIC UTILITY OF IMPULSIVITY IN ENTREPRENEURSHIP



Daniel A. Lerner, Deusto Business School, Spain

G. Christopher Crawford, Ohio University, USA

James Bort, Syracuse University, USA

Johan Wiklund, Syracuse University, USA

ABSTRACT

What's better: a higher volume of more impulsive and error prone decisions and actions, or a lower volume that is more accurate? This tradeoff has received extensive scholarly attention, but not in entrepreneurship, although the tradeoff is salient in this context. We build an agent-based simulation model, validated with PSED data, to examine the conditions under which impulsivity is (mal)adaptive. Our experimental results suggest that impulsive entrepreneurs are relatively less likely to successfully start a business irrespective of environmental uncertainty or munificence. However, of the entrepreneurs that emerge, the impulsive ones show somewhat larger growth on average and are four times more likely to achieve outlier growth. Thus, it seems that impulsivity has strategic utility for growth, but not organizational emergence.

INTRODUCTION

The tradeoff between decision speed and accuracy has received extensive attention in many scholarly fields (Heitz, 2014). To the best of our knowledge, however, it has not been studied within entrepreneurship. We believe that this is a major oversight, because entrepreneurship is an area where there is clear tension between acting fast and acting right, and where this tradeoff is both salient and important because the returns to speed can be enormous, whereas the cost of being wrong can be devastating. The SAT has its roots in action under uncertainty, which is the defining characteristic of entrepreneurship (e.g., McMullen & Shepherd, 2006). Overcoming this uncertainty and choosing the appropriate course of action is challenging—many new ventures fail within their first few years of existence (e.g., Delmar & Shane, 2003) and survival is increasingly challenging the higher the uncertainty, as with new ventures in new industries (Aldrich & Fiol, 1994). This speaks to the importance of accuracy. The rational approach is to wait and collect additional information so as to reduce uncertainty and choose the appropriate course of action as uncertainty subsides. On the other hand, windows of opportunities are open for limited amounts of time before they close and the rewards to those that are the first to move into a field can be substantial (Lieberman & Montgomery, 1988).

Both decision accuracy and decision speed have received extensive attention in entrepreneurship, but they have been studied separately. In this paper, however, we focus explicitly on SAT. There is research to suggest systematic individual differences regarding SAT. Some people prefer rapid actions under higher uncertainty, whereas other prefer to wait and choose the accurate course of action once uncertainty has dropped (Förster et al., 2003). We draw on these insights to build an agent-based simulation where the entrepreneurial behavior of agents who are biased towards speed over accuracy (impulsive agents) is compared to those who are not (typical agents).

The simulation concerns nascent entrepreneurial activities using real-world input from the Panel Study of Entrepreneurial Dynamics (PSED).

In carrying out this research, we make a number of contributions to the entrepreneurship literature. First, we illuminate the entrepreneurial conditions under which speed trumps accuracy and vice versa. There is plenty of anecdotal evidence that entrepreneurs may benefit from initiating action even if that action is incorrect and may lead to failure. We provide theoretical rationale and systematic evidence showing when this view is actually correct and when it is not. These findings also contribute to the small but growing literature related to how otherwise problematic individual characteristics – such as impulsivity – may actually be beneficial in entrepreneurship (*cf.* Lerner & Verheul 2016; Wiklund et al., 2016). Our results indicate that impulsivity decreases the probability of successfully establishing a business but increases the chances of achieving high growth. Further, entrepreneurship is often defined as the nexus of individuals and opportunities (Shane & Venkataraman, 2000), but very few studies have examined this nexus, which severely hampers the development of the field (Davidsson, 2015). Our agent-based simulation allows us to manipulate both individual characteristics and the nature of the opportunity in controlled ways. In a natural setting, differences related to individuals and opportunities are typically confounded (Grégoire & Shepherd, 2012). Thereby we provide evidence of fit and misfit between individuals and opportunities, which advances research at the very core of entrepreneurship. Finally, our empirical method (agent-based simulation) addresses the otherwise irreducible problem of endogeneity and unobservables, especially when studying phenomena like the establishment of a business over years (Reynolds & Miller, 1993).

THEORETICAL FRAMEWORK

There are stable SAT differences related to impulsivity. Research on impulsivity has a long and extensive history. Most definitions focus on behavior characterized by inability to wait, insensitivity to consequences, a tendency to act without forethought, an inability to inhibit inappropriate behaviors, or deficient tolerance to delay of gratification (Mobini et al., 2007). We build on the following definition, which resonates with SAT: “a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the [potential] negative consequences of these reactions” (Moeller, et al., 2001, p. 1784). Impulsive individuals tend to act fast with little forethought across situation and across time. In this, impulsivity represents a stable trait in the same way as the “Big 5” personality traits (Whiteside & Lynam, 2001).

The implications of impulsivity manifest most clearly under uncertainty (Kagan, 1965). Consistent with a preference for speed over accuracy, those high on impulsivity have a tendency to act under uncertainty rather than wait (Leland, et al., 2006). The main benefit of waiting is that as more information becomes available, uncertainty is reduced, providing greater certainty regarding if and when to act, increasing the probability of choosing the appropriate courses of action. Because of the inability to wait, impulsivity has been associated with a range of negative outcomes. Entrepreneurship involves action under uncertainty. Because the outcomes of novelty-creating entrepreneurial endeavors are unknown and unknowable at the time of action, uncertainty is inherent to the entrepreneurial process (McMullen & Shepherd, 2006; Sarasvathy, 2001). Thus, it is an ideal context for examining how SAT pans out under conditions of uncertainty. The establishment of a new organization is a time-consuming process fraught with uncertainty. Many nascent entrepreneurs abandon their efforts even before they have reached the state of an

operational business. For example, Delmar and Shane (2003) found that close to 40% of all startup attempts were abandoned before the firm was ever up and running.

Uncertainty typically triggers negative emotions such as worry, fear and anxiety (Loewenstein et al., 2001), which can lead to hesitancy, doubt, and procrastination among prospective entrepreneurs (McMullen & Shepherd, 2006). In contrast, positive feelings such as excitement and happiness can facilitate the initiation of action (Baron, 2008). Many entrepreneurs don't act despite expressing overt intention to engage in entrepreneurial behavior. For example, van Gelderen et al. (2015) find support for the notion that the uncertainty of entrepreneurial action evokes emotions of action aversion, action fear, and action doubt.

However, impulsive individuals find uncertainty exciting (Eysenck & Zuckerman, 1978) and weigh the potential reward inherent in a high level of uncertainty higher than the potential losses (Gray, 1970) because they discount the future more steeply. They experience little fear and anxiety when assessing an uncertain opportunity because they tend to ignore its potential downsides (Whiteside & Lyman, 2001). Because impulsive individuals are less concerned about the future consequences of their current actions, they are more likely to pursue riskier courses of action (Loewenstein et al., 2001)—such as business venturing in general, and riskier business ventures. Impulsive individuals who prefer speed over accuracy do not premeditate, but rather engage in behavior without careful consideration of the consequences, including limited evaluation of their ability to successfully carry out the behavior. As impulsive individuals typically avoid premeditation, they are less apt to gather and analyze information about an opportunity before acting. Thus, while they may more rapidly look for and act on opportunities, they do so with relatively less evaluation and preparation thereof.

On the basis of these insights into the behavior of impulsive individuals and the nature of entrepreneurship, we can make certain predictions of how impulsive individuals are likely to behave during the nascent entrepreneurial process, and the outcome of this behavior. The nascent entrepreneurial process unfolds over time and consists of a number of activities conducted over extensive periods of time before a business is up and running—on average around three years (e.g., Reynolds & Miller, 1992). Specifically, on the basis of our literature review, we believe that impulsive individuals will be more likely to engage in action to move their nascent ventures forward, and will complete these actions at a faster pace. Impulsive people who do not premeditate are less likely to carefully gather and analyze information about an opportunity before acting, thus not carefully evaluating the value of opportunities before exploiting them. At the same time, they will be less discriminatory in terms of ensuring they conduct the correct activities, but engage in any action they believe may bring the venture forward. Once they have engaged in behavior, impulsive people tend to become very focused on their tasks at hand and insensitive to negative feedback, forging ahead in the direction chosen (Patterson & Newman, 1993; Zermatten et al., 2005), conducting activities at a rapid pace (Smillie & Jackson, 2006). Impulsive entrepreneurs are thus likely to persist with opportunities although they may receive negative feedback. This will lead to a higher probability that they have to complete a larger number of activities before their businesses are up and running, increasing the risk that they run out of resources and have to disband before establishing a successful business. In a munificent environment, where there is ample access to resources, and where competition for these resources is not as fierce (Edelman & Yli-Renko, 2010), mistakes will be less costly and more reversible. At the same time, once a business is launched, a more munificent environment offers greater growth opportunities (Staw & Szwejowski, 1975). Thus, impulsive individuals are likely to be less punished for their error

prone approach, while being more rewarded for their greater action speed the more munificent the environment.

Importantly, not all opportunities entail the same amount of uncertainty. Impulsive individuals who are attracted to the positive upside but pay less attention to the potential downside will find uncertain opportunities with high growth potential particularly attractive despite the fact that they may entail higher probability of failure. For example, compared to those that are less impulsive, those that are high on impulsivity would be more attracted to starting a company such as Tesla, which involves very high upside potential but also very high downside risk of failure, compared to a more mundane business such as a coffee shop.

Relatively speaking, they may also perform particularly well for opportunities that involve greater uncertainty. Under very high uncertainty, the environment provides very few cues regarding appropriate action, and the relationship between actions and outcomes is blurry. Under these circumstances acting rapidly without much forethought can be particularly productive because the appropriate sequence of activities needed to successfully start a business is largely guesswork. The error-prone creation of variation typical of impulsive individuals may be particularly beneficial compared to thoughtful adaptation under these circumstances (Dickman, 1990). Actively experimenting with alternative courses of action is relatively more beneficial in environments characterized by more rather than less uncertainty (McGrath, 1999). On the basis of this, it would seem that compared to their more cautious counterparts, impulsive individuals may do better the higher the uncertainty. All arguments above lead to the following general proposition.

Proposition 1: Impulsivity has greater strategic utility for nascent entrepreneurs in environments that are more munificent and more uncertain.

METHODS

Our research question examines the potential emergence or failure in the process of new venture creation, questioning under what conditions a founder's impulsivity has strategic utility. Following prior theory-building efforts in organization science and entrepreneurship that use simulation experiments (c.f., Keyhani, Levesque, & Madhok, 2015), we develop a computational agent-based model to test the overall utility of an entrepreneurial agent operating with impulsivity—reflecting greater speed with diminished accuracy in capturing a given opportunity—relative to agents without such characteristics, over time.

Specifically, we presume that opportunities exist as resources in the environment that can be potentially acquired/exploited and continuously combined and recombined over time (Crawford, Dimov, & McKelvey, 2015; Lichtenstein & Brush, 2001). Similarly, we take a process-based view of opportunities and entrepreneurs, suggesting that the creation of new ventures is not a one-time event, but an outcome of a series of events over time (McMullen & Dimov, 2013). Thus, in the simulated environment, *opportunities* do *not* refer to a venture idea or a latent exploitable chance to purchase an existing business; in our model, opportunities are more micro and explicit in nature, representing the prospect to capture resources in the process of venture formation (e.g. successfully collecting market research, winning a pitch competition, or obtaining trade credit).

We build our agent-based model using the NetLogo simulation toolkit, version 6.0.1. We build the model hierarchically: the first, a baseline model to represent the most simple, globally applicable, and traditionally understandable state of nascent entrepreneurship, where an agent

searches for and attempts to capture opportunities in the environment as a means of starting a new venture. Once the baseline model is sufficiently validated with empirical outcomes, we build additional components onto it, and run computational experiments to investigate our research question. Primary components of the model are outlined below.

Experimental setting: Simulated environment (2D chessboard-like grid of cells) where agents that represent nascent entrepreneurs attempt to capture resources of three different values—small, medium, and large—with probability of successful capture lowered by 50% for increased size. Each experiment is run for a simulated three-year period.
Agent behaviors: Typical agents (TAs) search and move in a 20-cell pattern, attempting to capture opportunities in a somewhat rational order, from smallest to largest. Impulsive agents (IAs) search and move in a 24-cell pattern, continually attempting to capture whatever opportunity they see first. Probability of successful resource capture is discounted for IAs.
Empirical proxies for baseline model: <i>Inputs:</i> Probability for successfully capturing opportunity discounted by 13% for IAs compared to TAs (Dickman & Meyer 1988; Lerner, 2016); range of % of IAs to TAs from impulsivity in ADHD 10% of US population (CDC 2016), and ADHD accounts for up to 16% of business owners (Shane 2010). <i>Outcomes:</i> Successful organizational emergence (54%, Tornikowski & Newbert 2007, US PSED) and venture disbanding (37%, Delmar & Shane 2004, Swedish PSED).
Outcomes of interest: %IA vs. %TA <i>successful organizational emergence</i> , as measured by accumulation of a predetermined level of resources; %IA vs. %TA <i>venture disbanding</i> , as measured by expending all their resources. IA vs. TA <i>relative growth</i> , as measured by average increase in captured opportunities.
Experimental manipulations: <i>Environmental uncertainty</i> , modeled as percentage of opportunities that <i>ex post</i> are not true opportunities but rather have a value of zero—baseline (10%), <i>low</i> (5%), <i>high</i> (15%); <i>Environmental munificence</i> , modeled as total number of all opportunities—baseline (11000 small:8000 medium:650 large), <i>low</i> (-50%), <i>high</i> (+50%).
Controls: Number of agents; ratios of small:medium:large opportunities; IA and TA initial resources; probability of resource capture for each agent type for each opportunity size.
Statistical analyses: Monte Carlo simulations, using same input parameters over 100 separate three-year model run, and reporting the average outcome; sample t-tests of differences of outcomes <i>between</i> agent types.

(SURPRISING) RESULTS

Given that we *verify* all of our model inputs and interactions with the literature, and subsequently *validate* all of our model outcomes with empirical findings from the most theoretically generalizable samples of nascent entrepreneurial action (PSED-type studies), it is somewhat surprising that neither of our propositions was supported. In environments of both high and low uncertainty and in environments of both high and low munificence, IAs were *significantly less likely to successfully emerge* and *significantly more likely to disband* than TAs. Thus, relative to typical (non-impulsive) nascent entrepreneurs, impulsivity did not appear to have strategic utility, on average, in any environment. Our additional experiments studying of relative growth yielded inconclusive results. In terms of nascent venture growth, IAs outperformed TAs, increasing initial endowments by 43% compared to 37% from year three to year four; however this difference was not statistically significant.

The experimental results that we report are from Monte Carlo simulations. These simulations are somewhat akin to a meta-analysis or bootstrapping, with the experiment/model run 100 times with the exact same input parameter settings—and, like previous simulation studies, we report the average (mean) of our outcomes of interest (Davis, Eisenhardt, & Bingham, 2009). In effect, running the model *one* time is equivalent to one PSED study or randomized experiment, and each subsequent model run is a form of replication. While replication studies have been espoused for general domain knowledge accumulation, as well as for entrepreneurship theory building (Davidsson, 2016), the inherent nature of Monte Carlo simulations may somewhat bias our results against Impulsive Agents.

Averaging all outcomes over a constrained period of time is much more likely to result in a relatively symmetrical distribution, where most observations regress to the “modest majority.” As alluded to in our development of theory, impulsivity is often characterized as a behavioral disorder that has the potential for extreme outcomes. Obviously, this could be manifested in venture failure; however, extreme outcomes in nascent entrepreneurship could also be akin to receiving \$50M in venture capital funding or being awarded a \$100M government grant for space exploration. Instead of replicating our study and averaging out the extremes, we also want to observe the outliers.

Accordingly, for our final experiment, we ran the baseline model once. Looking at absolute growth, as measured by the number of resources accumulated through three simulated years for the 328 agents that did not fail, there were 14 outliers. Though IAs accounted for only 15% of the total population, they accounted for 64% of all the growth outcomes that were greater than three standard deviations above the mean. In other words, IAs were approximately 4-times more likely to be a positive outlier.

DISCUSSION & IMPLICATIONS

Theoretically, impulsiveness reasons to be adaptive for entrepreneurial action—in line with recent empirical studies (Wiklund et al., 2016a; 2016b; Lerner & Verheul, 2016). Yet beyond just taking action, questions remain as to whether it helps or hinders business venturing. Based on the controlled simulation experiments run, we find that in regards to venture emergence, impulsivity is a liability—regardless of differential levels of environmental uncertainty or munificence. However, impulsivity appears to be relatively adaptive in regards to nascent venture growth. As such, the potential strategic utility of impulsivity seems conditional on the entrepreneurial outcome of interest. These findings offer a grounded basis for further consideration of the role and effects of impulsivity in the entrepreneurial process and business venturing outcomes.

CONTACT: Daniel Lerner; daniel.lerner@colorado.edu; Deusto Business School, Bilbao, Spain.